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ABSTRACT

Findings of a study that examined the relationship between variations in patterns of school leadership and group problem-solving process are presented in this paper. Interviews were conducted at the beginning and end of the school year with 12 principals in British Columbia who had implemented the Primary Program. The initiative was designed to restructure the first 4 years of schooling through such organizational changes as ungradedness, continuous progress, dual-entry periods to kindergarten, and active student participation in learning. Findings indicate that principals who engaged in both indirect and direct forms of instructional leadership demonstrated significantly higher levels of group problem-solving expertise than did building-centered and teacher-centered managers. This suggests that the thinking that gives rise to instructional leadership practices is similar to the thinking that creates an expert collaborative problem solver. Second, differences among principals in 10 dimensions of group problem solving were most evident in principals' purposes, skills and knowledge, and dispositions. Finally, the most effective forms of leadership were associated with women who had limited formal experience as principals. An implication is that administrator preparation curricula should be organized around a grounded view of the principal's world. Four tables are included. (Contains 44 references.) (LMI)

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The Relationship Between Variations in Patterns of School Leadership and Group Problem-Solving Processes

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The Relationship Between Variations in Patterns of School Leadership and Group Problem-Solving Processes

Kenneth Leithwood and Rosanne Steinbach

The field of educational administration has been inordinately late in recognizing the value of knowing more about how its practitioners think and the processes they use to solve problems central to their work. This is the case in spite of compelling evidence accumulating in closely allied, if not overlapping, fields (Schwenk, 1983). The present study is part of a larger program of research, begun in 1986, aimed at addressing this neglect. Many earlier products of the program have been described in Leithwood, Begley and Cousins (in press), as well as elsewhere. Our most recent work (Leithwood, Steinbach & Dart, in press) has explored directly the relationship between problem-solving processes and different patterns of administrative practice. This research reflects increased attention to the importance of domain-specific knowledge in explaining variation in the quality of administrators' problem solving. Relationships between problem-solving expertise and length of administrative experience, gender, and organizational size also have been examined.

These several foci of our most recent work have been pursued in the context of school improvement problems largely solved by principals individually. Evidence from earlier work, however, suggests that as administrative problems become more complex (many school improvement problems are of this sort) and as administrators' experience and expertise increases, they are more inclined to involve others in solving problems collaboratively (Leithwood & Steinbach, 1990). This rise in collaborative problem solving appears to be justified on the grounds that it leads to better solutions, increased commitment to those solutions, and long-term growth of participants (Leithwood & Steinbach, 1991). These benefits are due in large measure, to evidence concerning the severe limits placed on an individual's processing of information by the restricted capacity of "short-term" or "working" memory. Herbert Simon (1957) captured this limitation concisely with the term "bounded rationality".

The study described in this chapter is a further exploration of the nature of collaborative problem-solving processes. It parallels Leithwood, Steinbach, & Dart (in press) using the same sample of administrators, but describing their problem solving in collaboration with their staffs rather than by themselves. The sample consisted of selected principals in British Columbia, Canada, who were attempting to improve their schools through the implementation of a major Ministry of Education policy initiative. Called the Primary Program (1990) this initiative aimed to restructure the first four years of schooling through such organizational changes as ungradedness, continuous progress and dual entry periods to kindergarten. Instructional changes were premised

on a constructivist image of learning and aimed at the type of active participation of students in their own learning evident, for example, in "whole language" approaches to instruction (e.g., Watson, 1989). Anecdotal reporting to parents, greater parent involvement as "partners" in instruction and a concern for better meeting the needs of a culturally diverse population of students were among some of the other elements of the Primary Program. The program was, itself, part of a broader set of policies (Year 2000, 1989) to be implemented through the end of secondary school over a ten year period.

Framework

Patterns of School Leadership

One obvious explanation for variation in principals' contribution to school improvement is offered by research describing differences in the practices they use for this purpose (Hall, Rutherford,Hord, & Huling, 1984; Blumberg & Greenfield, 1980; Salley, McPherson, & Baehr, 1978; Leithwood & Montgomery, 1986; Hoy & Brown, 1986; Blase, Dedrick & Strathe, 1986; Brady, 1985). Four distinct patterns of practice (or styles) are evident in this research, which Leithwood, Begley and Cousins (1990) have summarized as follows:

> Leadership style [or pattern] A is characterized by a focus on interpersonal relationships; on establishing a cooperative and genial "climate" in the school and effective, collaborative relationships with various community and central office groups. Principals adopting this style seem to believe that such relationships are critical to their overall success and provide a necessary springboard for more task-oriented activities in their schools.
>
> Student achievement, well-being and growth is the central focus of leadership Style B. Descriptions of this class of practices suggest that while such achievement and well-being are the goal, principals use a variety of means to accomplish it. These include many of the interpersonal, administrative, and managerial behaviors that provide the central focus of other styles.
>
> Compared with styles A and B, there is less consistency, across the four dozen studies reviewed, in the practices classified as style C (programme focus). Principals adopting this style, nevertheless, share a concern for ensuring effective programmes, improving the overall competence of their staff, and developing procedures for carrying out tasks central to programme success. Compared with style A, the orientation is to the task, and developing good interpersonal relations is viewed as a means to better task achievement. Compared with style B, there is a greater tendency to view the adoption and implementation of apparently effective procedures for improving student outcomes as a goal - rather than the student outcomes themselves.
>
> Leadership style D is characterized by almost exclusive attention to what is often labelled "administrivia" - the nuts and bolts of daily school organization and maintenance. Principals adopting this style, according to all four studies, are preoccupied with budgets, timetables, personnel administration, and requests for information from others. They appear to have little time for instructional and curriculum decision making in their schools, and tend to become involved only in response to a crisis or a request. (p. 12-13)

There is considerable evidence to warrant the claim that patterns B and C make the greatest contribution to school improvement - especially pattern B (e.g., Leithwood & Montgomery, 1982; Heck, Larsen & Marcoulides, 1990). Indeed, these four patterns appear to represent a hierarchy in terms of their contribution to school improvement with the student growth focus (B) making the greatest contribution followed in diminishing order by the program focus (C) the interpersonal relationships focus (A) and the building manager focus (D) (Leithwood & Montgomery, 1986; Hall et al., 1984; Stevens & Marsh, 1987; Trider & Leithwood, 1988). Such differences in effectiveness are partly explained by the increased inclusivity of patterns closer to the student growth focus; this focus, for example, also includes attention to building management, school climate and school programs but as 'means' to the student growth 'end' not as ends themselves.

The prior study out of which this one builds most directly (Leithwood, Steinbach & Dart, in press) found evidence of all four patterns of practice in principals' school improvement efforts. In that study, both patterns B and C were considered to be variations of "instructional leadership". Among principals demonstrating such leadership, some did so in a very direct way - through modelling new forms of teaching for example; others provided such leadership indirectly by ensuring, for instance, that new forms of instruction were modelled but not doing the modelling themselves. Both forms of instructional leadership included concern for creating conditions in the school (second order changes) which would give teachers the best chance of successfully implementing the Primary Program. Three principals were classified as direct instructional leaders (DIL) and five were classified as indirect instructional leaders (IIL).

The third pattern of practice corresponds to leadership style A (interpersonal relationship focus). We labelled it teacher-centred management (TCM). These principals were supportive of the school improvement effort and reasonably knowledgeable about the Primary Program. They were also intellectually engaged in the improvement process, interacting from time to time with teachers. But their involvement was neither intensive nor particularly direct. Two principals in our study demonstrated this pattern.

The fourth pattern of practice closely corresponds to what was described earlier as leadership D (Building manager focus). Two of the twelve principals in our study demonstrated such a focus which we labelled building-centred management (BCM). These principals, concerned mainly with budgets, timetables, etc., were only minimally involved with the Primary Program.

Evidence from the Leithwood,Steinbach, & Dart (in press) study also supports the claim that the four patterns of practice constitute a hierarchy of effectiveness. Dependent variables in that study included the form of the schools' culture, changes in the attitudes and behaviours of teachers, and teachers' perceptions of the helpfulness of the principals' leadership. So, for example, the school improvement efforts of direct instructional leaders (Style B) as compared with building managers (Style D) were associated with greater professional collaboration among

teachers. Those efforts also were associated with more positive attitudes on the part of teachers toward the improvements being attempted in the school and more changes in teachers' classroom practices reflecting the intentions of such improvements. Teachers working with instructional leaders also valued more highly those leaders' assistance in implementing school improvements.

Problem-Solving Processes

What principals do depends on what they think. More specifically, the patterns of practice used for school improvement are products of how principals think about and approach not just the overall problem of school improvement but also the multitude of smaller, imbedded sub-problems. Only recently, however, has systematic research begun to be devoted to the thinking and problem solving of educational administrators and accumulated evidence to date is quite small. Considerably more research has been reported on the problem solving and strategic thinking of managers and leaders in non-educational organizations (Schwenk, 1988; Srivastva, 1983). Without a better understanding of principals' thinking and problem solving, it is difficult to explain differences in their school improvement practices; nor are attempts to assist principals in acquiring more effective patterns of practice likely to be especially successful. Further, a significant number of school improvement problems are unpredictable and must be solved in contexts which are highly variable. Under such contingent circumstances, it is unlikely that any single set of specific interventions will be reliably effective (Leitner, in press). Much more important is the quality of those problem-solving processes (or thinking) giving rise to practice.

The present study inquired about principals' thinking and problem solving using theoretical orientations to and results from our own program of research in this area. Taking contemporary cognitive science theory as a point of departure (e.g., Frederiksen, 1984; Voss, et al., 1983; Chi, Feltovich & Glaser, 1981) this research has investigated differences in the problem solving processes of 'expert' and typical principals. Among the most significant results of this research to date is a model of educational administrators' problem solving consisting of six constructs defined as follows:

- *Interpretation:* a principal's understanding of specifically what is the nature of the problem, often in situations where multiple problems may be identified;
- *Goals:* the relatively immediate purposes that the principal is attempting to achieve in response to his or her interpretation of the problem;
- *Principles/Values:* the relatively long-term purposes, operating principles, fundamental laws, doctrines, values and assumptions guiding the principal's thinking;
- *Constraints:* "barriers or obstacles" which must be overcome if an acceptable solution to the problem is to be found;
- *Solution Processes:* what the principal does to solve a problem in light of his or her interpretation of the problem, principles, and goals to be achieved and constraints to be accommodated;

- *Affect:* the feelings, mood and sense of self confidence the principal experiences when involved in problem solving.

Leithwood & Stager (1989) and Leithwood and Steinbach (1990) described processes associated with each of these constructs used by both expert and typical samples of administrators solving problems individually. Leithwood & Steinbach (1991) provided similar data but in a collaborative problem-solving context. Table 1, summarizing the results of that study, was used as a starting point for coding and analyzing data in the present study. Aspects of collaborative problem solving described in Table 1 and signified with an asterisk were incorporated into the coding form for the present study. As the asterisks indicate, emphasis in the present study was on the solution process component, in particular.

Table 1 Principals' problem-solving processes with others:
A comparison of expert and typical principals. (From Leithwood & Steinbach, 1991)

Components	Experts	Typical
Interpretation	• understands importance of having a clear interpretation of problem	• does no conscious reflection on this matter
	• seeks out and takes into account the interpretation others have of the problem	• assumes others share same interpretation
	*• immediate problem usually viewed in its relation to the larger mission and problems of school	• has tendency for problems to be viewed in isolation
	• has a clear interpretation which he/she can describe to others and rationalize	• has less clarity about the interpretation; difficulty in explaining it to others
	*• has multiple goals for problem solving	• has multiple goals for problem solving
	• shares own goals with others involved in problem solving	• shares own goals with others involved in problem solving
Goals	• has goals for both the problem and the meeting in which collaborative problem solving occurs	• has goals for both the problem and the meeting in which collaborative problem solving occurs
	• has a strong concern for the development of goals both the principal and staff can agree to	• is concerned with achieving only own goals and getting staff to agree to those goals
	*• has less of personal stake in any preconceived solution; wants the best possible solution the group can produce	• is often strongly committed to a preconceived solution and attempts to manipulate group problem solving to result in support for the preconceived solution
Principles/Values	• order of frequency of mention of value categories: Professional Values, Basic Human Values, Social and Political Values, and General Moral Values	• order of frequency of mention of value categories: Professional Values, Basic Human Values, Social and Political Values, and General Moral Values
	• most frequently mentioned specific value: Specific Role Responsibilities	• most frequently mentioned specific value: Specific Role Responsibilities
	• mean total of 21 value statements	• mean total of 16.6 value statements
	• high use of specific values: Respect for others, Participation Consequences for clients, Knowledge - in that order	• high use of specific values: Consequences for clients, Respect for others, Loyalty, Happiness - in that order
Constraints	*• accurately anticipates obstacles likely to arise during group problem solving	• does not anticipate obstacles or identifies relatively superficial ones

Table 1 (continued)

Table 1 (continued)

Components	Experts	Typical
	• plans in advance for how to address anticipated obstacles	• rarely considers in advance how to respond to obstacles that are predicted
	*• adapts and responds flexibly to unanticipated obstacles which arise	
	• views obstacles not as major impediments to problem solving	
Solution process	*• has well-developed plan for collaborative problem solving (meeting)	• rarely plans for collaborative process and may value "spontaneity"
	*• provides clear, detailed introduction to problem and its background to collaborators	• introduces problem unclearly and occasionally misses altogether
	*• outlines clearly the process for problem solving (e.g. how meeting will be conducted)	• is not likely to share plan for meeting with collaborators if plan exists
	*• carefully checks collaborators' interpretations of problem and own assumptions	• assumes others have same interpretations of problem; does not check
	*• without intimidating or restraining others, clearly indicates own view of the problem and relationship with larger problems	• argues stubbornly for own view or "orchestrates" meeting so that it supports such a view
	*• remains open to new information and changes views, if warranted	• adheres to own view in the face of competing views
	*• assists collaborative problem solving by synthesizing, summarizing, and clarifying as needed and by keeping group (gently) on track	• uses limited action to assist collaboration and may seriously underestimate time required for collaborators to explore problem as principal has
	*• ensures that follow-up is planned	• rarely considers plans for follow-up
Affect	*• always appears to be calm and confident	• usually appears calm but frustration may occasionally become visible
	• hidden anxieties usually the result of inability to find a workable solution	• frequently feels frustrated, especially by unwillingness of staff to agree with principal's views
	*• invariably treats others politely [shows respect and courtesy to staff]	• shows occasional signs of insecurity about own ability to solve problems
	• uses humor to diffuse tension and to clarify information	• uses humor to diffuse tension and to clarify information

Building on this prior research, the study described in this chapter addressed three sets of questions:

- Are variations in school improvement leadership practices associated with variation in group problem-solving processes?
- Within which aspects of group problem solving do principals demonstrate greatest variation?
- To what extent are variations in leadership practices and group problem-solving processes associated with principals' age, administrative experience and gender?

Method

Twelve schools in three districts (four schools per district) were selected for the study. Eight of these schools had volunteered to be pilot schools ("Lead Schools") for implementing the new Primary Program policy. Four were chosen from the seven elementary schools in one district which were initiating activities related to the policy.

Data related to principals' thinking and problem solving were collected at two points in the year (fall and spring). At the beginning of the school year (about 2 1/2 months after the start of implementation) principals were asked how they were going about solving the current school improvement problem, i.e. implementing the Primary Program policy. Using a semi-structured interview schedule, principals were asked to describe the problem and then discuss what they wanted to accomplish, the values that might be influencing them, constraints that might be impeding progress, and the specific steps taken to solve the problem. These interviews provided the data for the study reported in Leithwood, Steinbach, & Dart (in press). As discussed earlier, that study described the four patterns of practice exhibited by the twelve school leaders.

Toward the end of the school year principals were interviewed again. This time they were asked to reflect on their thinking during a previously taped staff meeting called to address a problem related to implementation of the school improvement policy. Instead of having principals rely on their memories of what occurred at the meeting, an audio tape was used to "stimulate recall".

Data for this set of interviews were collected on three occasions. Prior to the staff meeting, principals were interviewed about the nature of the problem they would be working on, what they expected and wanted to happen at the meeting, and what they were planning to do. Next, an audio tape recording was made of the portion of the staff meeting addressing the chosen problem. Finally, after some preliminary instructions, the principal and interviewer listened to the tape of the meeting together, stopping frequently to ask questions or offer information about intentions and thought processes. This discussion was recorded on a separate tape, which was subsequently transcribed carefully to eliminate all identifying characteristics. These transcripts provided the data for the present study.

Based on the findings of our previous research on the collaborative problem solving of expert and typical principals (see Table 1), along with some additional insights, a coding form for analyzing the data was developed including 18 determinants of collaborative problem solving. This coding form focussed most heavily on the solution process steps used by principals, although key items related to the interpretation, goals, constraints, and mood components of our problem solving model were also included. New components examined were principals' use of problem relevant knowledge, the degree/quality of self-reflection, and staff development as a goal for staff meetings. In order to quantify the analysis, responses were classified according to the coding form and rated on a five point scale (expert = 5 points, typical = 1 point). To earn a rating of 5, responses had to be explicit and/or appear three or more times.

Each transcript was divided into relevant statements made by the principal which were then numbered sequentially. Two researchers worked together, using two training protocols, to classify and rate each statement. Once the raters felt comfortable with their degree of understanding, they coded and rated the ten remaining protocols independently. Interrater reliability was .73 (Pearson Product Correlation). Although this is an acceptable level of reliability a check of the data indicated that it did not adequately reflect the extent of rater agreement. Except for a very few occasions, ratings never differed more than one point and a test failed to identify any significant differences between the raters ($t=0.99$, $p=0.32$). In addition, when mean scores given by each rater for each principal were compared, the correlation was .87. All differences in ratings were discussed, disputes were resolved, and principals were assigned a single score for each of the 18 items on the coding form. A mean score was also computed for each principal.

Results

This section summarizes data collected in response to the three questions guiding the study.

Patterns of Practice and Group Problem-Solving Processes

Are different patterns of practice or approaches to school improvement by principals associated with or perhaps even partly explained by differences in the processes used to solve problems in groups? To answer this question, differences in the total mean ratings for the group problem-solving processes of principals engaged in each of the four patterns of practice were compared. As Table 2 indicates, DILs and IILs exhibited greater expertise than TCMs or BCMs. A one-way analysis of variance was followed by a Tukey post-hoc procedure to locate pairs of means which differed significantly. Differences in expertise between BCMs and each of the other patterns were significant [$f(3, 8) = 14.18$, $p<.05$]. Principals engaged in both instructional leadership patterns also demonstrated substantially greater problem-solving expertise than did teacher-centred

managers, but that difference did not reach significance. In sum, then, differences in patterns of practice are associated with differences in group problem solving processes.

Table 2

Mean Ratings of Group Problem-Solving Expertise for Principals Engaged in Four Different Patterns of Practice

Style	N	Mean	SD
		Scale (1=typical; 5=expert)	
Direct Instructional Leader (DIL)	3	4.02	.27
Indirect Instructional Leader (IIL)	5	4.08	.49
Teacher-Centred Manager (TCM)	2	3.53	.35
Building-Centred Manager (BCM)	2	2.03	.04

Aspects of Greatest Differences in Principals Problem-Solving Processes

Table 3 reports the total mean ratings on each of the 18 aspects of problem solving examined in this study for principals engaged in each of the four patterns of practice. It is clear from this table that the scores for the building-centred manager pattern are substantially lower than those of the other three patterns on nearly every item. A one-way analysis of variance showed that those differences were significant ($p<.05$) for items 9, 13, 16, and 17. BCM scores were also significantly lower than DIL and IIL (but not TCM) scores on items 1, 4, 14, 15, and 18. BCM and IIL leaders differed significantly on item 3. And for item 18, TCM scores were significantly lower than those for IILs. The nature of these statistically significant differences falls into three main categories (goals, skills and knowledge, and disposition) which are described in more detail in the remainder of this section.

Goals

Goal setting is vitally important in the running of any meeting and shared understanding of goals is of particular importance in collaborative problem solving. A prior study (Leithwood & Steinbach, 1991) suggested that expert and typical principals were equally adept at sharing their own goals with others involved in problem solving. Similarly, all principals in the present study at least mentioned the purposes for problem solving at the outset of their meetings with staff. However, three goal-related dimensions of group problem solving did show significant variation among principals; they are items 1, 17 and 18.

Table 3

Dimensions of Group Problem Solving:
Mean Ratings for Each Pattern of Practice

	ITEMS	MEANS (scale=1-5) DIL (n=3)	IIL (n=5)	TCM (n=2)	BCM (n=2)
*1	Immediate problem viewed in relation to the larger mission and problems of school	4.3	4.8	3.5	2.0
2	Less of a personal stake in pre-conceived solution; want best possible group solution	4.3	3.4	4.5	2.5
*3	Anticipates obstacles, responds flexibly to unanticipated obstacles, deals with constraints	3.7	3.6	3.5	1.5
*4	Has well developed/prepared plan for meeting	4.7	4.8	3.5	2.0
5	Provides clear, detailed introduction to problem and its background to collaborators	4.3	3.8	3.5	2.5
6	Outlines clearly the problem solving process	3.7	3.6	3.5	2.5
7	Without intimidating or restraining others, clearly indicates own view of problem	3.7	3.0	3.5	2.5
8	Remains open to new information (flexibility)	3.7	4.0	4.0	3.0
*9	Assists collaborative problem solving by synthesizing, summarizing and clarifying	3.7	4.6	4.5	2.0
10	Has strategies for keeping group focused and allowing discussion	3.7	4.2	3.5	3.0
11	Checks for consensus, agreement, understanding, commitment	3.7	4.0	3.5	2.0
12	Ensures that follow-up is planned	3.3	4.0	2.5	2.0
*13	Always appears to be calm and confident	4.0	4.2	3.5	1.5
*14	Respect and courtesy shown to staff during meeting and interview	4.7	4.2	4.0	1.5
*15	Use of problem related knowledge	4.0	4.2	3.0	1.5
*16	Indication of self-reflection, self-evaluation	4.7	3.6	3.5	1.5
*17	Broad range of goals (includes program/student goals)	4.3	4.6	3.5	1.5
*18	Staff development an explicit goal of meeting	4.0	4.8	2.5	1.5

Item 1. The impact of instructional leadership on students is indirect. Among the most powerful mechanisms for exercising this leadership is influencing what teachers focus on by ensuring that the school's mission is clearly defined (Leitner, in press; Hallinger, Bickman & Davis, in press). Group problem solving provides school leaders with an opportunity to draw attention to the school's mission and to assist staff in finding meaning in that mission by showing its relevance in the solution of everyday problems. Given the importance of the school's mission, more expert principals would be expected to invest more effort in helping staff place the immediate problem being addressed in relation to the larger mission and problems of the school (item 1). Such was the case with principals in this study.

Each DIL and IIL received a rating of 4 or 5 on this aspect of their problem solving. To illustrate, one principal introduced the problem to be addressed by staff in this way:

> The topic of retention is a contentious one for primary grades or any grades . . . and it forces us, as teachers, to examine the reasonings behind recommending retention or promotion. So we need to think about whether a student's education career should be driven by competence, by readiness, by age, or group solidarity, or whatever. It makes us - pushes us really to think about why we do certain things.

The mean score for the TCMs was 3.5. This indicated that the problem was seen in a larger context, but that the context often was limited to staff opinions or feelings. The problem of class assignment, might be viewed just from the perspective of personnel, for example:

> So, that was a factor that they had, which impinged on their decision-making, because they were not only thinking of the classes, they were thinking of personnel as well. Little factors such as, Mrs. M. - her last year's coming, she's going to retire. She doesn't want to do any major changes in the time of her career . . .

Each BCM received a score of 2 for this item. This means that the immediate problem was viewed in isolation. For example one principal who was dealing with complaints of limited resources kept the problem at that level.

> So a lot of money has gone into it; it's really disappointing to see boxes of the same stuff arriving for each classroom . . . that's just my personal opinion.

Item 17. Research on social cognition places individuals' internalized goals at the centre of explanations of self-motivation (e.g. Showers and Cantor, 1985). As Bandura (1977) explains:

> . . . [they] represent future consequences in thought . . . Many of the things we do are designed to gain anticipated benefits and to avert future difficulties. When individuals commit themselves to explicit goals, perceived negative discrepancies between what they do and what they seek to achieve create dissatisfactions that serve as motivational inducements for change (p. 161).

In order for a school to pursue a common mission, individual staff members' practices have to be motivated by at least a significant core of common goals related to that mission. Among the especially important aspects of school leadership expertise, then, is the effort devoted to and success in creating that common core of goals among staff. Expertise is a function of both the nature of the goals school leaders assist staff to adopt and the extent to which a common core of goals is actually internalized by staff.

Significant differences were found among principals in relation to the nature of the goals espoused for problem solving, particularly in their breadth and in the incidence of program and student goals (Item 17). Such goals are one of the defining features of instructional leadership (Leithwood & Montgomery, 1982; 1986) and principal expertise (Leithwood & Stager, 1989). All DILs and IILs in the present study were rated either 5 (explicit mention) or 4 (implicit mention) on this item. Student growth and/or program goals were used as benchmarks to help guide problem solving. For example one principal set student needs as a goal by saying:

> So I think what we have to look at is what makes the best sense for the kids at this school.

And, to help reach consensus about how to evaluate students using the new reporting procedure another principal said:

> . . . What we have to do here is get really clear in our minds that the report has got to enhance the learning of the child.

TCMs were weaker on this dimension (mean = 3.5): One TCM had several goals but none were related either explicitly or implicitly to what was best for children. He received a score of 3. The second TCM did indicate that reporting procedures should be a fair assessment of the child's development or potential. This implicit goal gave him a score of 4.

The main goal of both BCMs was to comply with the researchers' request. As one BCM said to his staff:

> I believe what the [research team] would like us to do is to hear us talking over the difficulties of implementation. (Score = 1)

The second BCM's goal was to discuss what was good and bad in the past year so priorities could be set. There seemed to be no higher learning goals - only task goals. (Score = 2).

Item 18. The extent to which staff development explicitly was considered to be a goal by principals in solving school improvement problems with their staff was an aspect of problem solving not examined in our previous research. It was included in this study for two reasons. Our choice of a focus on the domain of school improvement problems, in particular, was the first reason. Inferences about effective practice derived from recent research on school improvement (reviewed by Fullan, 1991) argue that it is more productive to focus broadly on capacity building within the school rather than more narrowly on the implementation of specific innovations.

A second reason for attending to staff development as a goal is inherent in the meaning of collaboration. Authentic collaboration depends on a belief in the value of the contributions that can be made by one's collaborators. Such a belief requires principals not only to view staff as possessing capacities critical to the solution of school improvement problems but to aim at improving those capacities, as well.

Most DILs and IILs received high scores (4 or 5) on this dimension (one received a 3). They seemed to see their roles as instructional leaders for teachers as well as for students. The three DILs had a mean score of 4. The five IILs had a mean score of 4.8. These are principals attempting to accomplish student goals through staff development and they use staff meetings as opportunities to do this. Four of these five principals were very explicit about having staff development as a goal for the staff meeting (score = 5), the fifth was slightly less explicit. Comments such as the following, illustrate how this goal was expressed:

> . . .I wanted them to understand the process that one goes through when you start putting a class group together.
> . . .So I wanted all of this [talk] so that they could know what each other is thinking, where they're coming from . . .

The mean score for TCM's on item 18 was 2.5. While there was definitely concern for teacher feelings, teacher development was not so clearly a goal. One TCM received a score of two. He wanted to understand the staffs' rationale for their choice of class configuration and he wanted to ensure that staff were satisfied with their choice. The second TCM received a score of 3. He turned the meeting over to the teacher who had initiated the topic and attempted to ensure everyone had an opportunity to speak. The tenor of the meeting was very "empowering".

BCMs had a mean score of 1.5. One BCM received a score of 1 because his only real goal was to comply with the researchers' request for him to tape a meeting. The second principal received a score of 2. His goals were to comply with the researchers' request, to make sure class lists were in order, to make certain that staff were organized to advise the new principal, and to discuss what was good and bad in the past year so priorities could be set. The score of 2 was given because, at the end of the meeting, he said to the interviewer: "I just expected them to be able to have a free expression of views more than anything."

Skills and Knowledge

The limits on individual problem solving, which Simon (1957) described as "bounded rationality", are due to short term (or working) memory capacity; individuals are able to process or think about only 5 to 7 separate items of information at a time. For this reason, individuals may (a) consider only a small number of the actually available alternative solutions to a problem:, (b) possess less than adequate information about these alternatives, (c) consider the problem from narrowly biased perspectives (d) overlook relevant criteria in decision-making. Each of these

limitations on individual problem solving can be overcome in a collaborative context -- two (or more) heads are better than one, *under the right circumstances*.

Our prior research on group problem solving (Table 1) described some of the specific skills used by expert administrators to ensure such circumstances during their meetings. Results of the present study point to many of the same skills with differences between patterns of practice reaching sigfnificance on four items: 3, 4, 9, and 15.

Item 3. The ability to anticipate obstacles and deal with them if they arise unexpectedly is a component of individual problem-solving expertise. It is an important feature of collaborative problem solving as well.

DIL, IIL, and TCM mean scores were very similar: 3.7, 3.6, and 3.5 respectively. All of these principals either anticipated obstacles and prepared themselves for them ("And so I had to be prepared for reluctance initially") or else responded casually and flexibly to unanticipated constraints. While there was some frustration, it was not apparent to the staff.

In contrast, building-centred managers received a 2 and a 1 for this item (Mean = 1.5). For these two principals, obstacles were seen as anything that impeded the desired smooth path of the meeting and they reacted to these stumbling blocks with poorly disguised anger.

> . . . the [partner school] issue is a separate issue, J. and I'd like to talk to you about it, because you may not be aware of the time that [your school] is getting. So, I'll talk to you later. (Interviewer: You sound a little bit annoyed) I am.

Item 4. "A plan", as Shank and Abelson explain, "is a series of projected actions to realize a goal (1977, p. 71)." Prior research on both individual and group problem solving by administrators suggested that experts, as compared with non-experts, verbalized more detailed plans for how to solve their problems. In some cases, they were able to anticipate a series of a dozen or more actions they would take. Often they considered alternative steps in response to different possible outcomes of a given action (Leithwood & Steinbach, 1991; Leithwood & Stager, 1989). In a group context, such detailed contingent planning has both instrumental and symbolic value. Instrumentally it increases the probability of reaching one's goals and makes for a well-run meeting. Such planning also signals to staff that the issue being addressed in the meeting is important and that the principal doesn't want to waste their time.

DILs and IILs scored very highly on this dimension (mean scores were 4.7 and 4.8 respectively). Each of these principals had spent considerable time preparing for the meeting either by gathering materials (e.g. unifix cubes or research articles), or by making extensive notes summarizing the results of a previous meeting. As one principal noted:

> What I've done since that last meeting was . . . to take all the items listed on the board that members raised and try to cluster them into some kind of logical grouping.

TCMs did plan, but their plans were less elaborate; the mean score for this group was 3.5.

> Those are my plans on paper, which they have a copy of ... I gave each of them ... the three scenarios [they had arrived at].

BCMs appeared to value spontaneity (although they reacted with annoyance if things didn't go according to their own internal agenda); planning was kept to a minimum. For example, as one BCM said to his staff:

> Umm, I guess they [the researchers] want to know how I deal with problems so I'll just toss it open for discussion.

Item 9. This item, perhaps more than the others, captures the critical skills necessary to facilitate collaborative problem solving. Except for the two BCMs, scores were consistently high (DIL = 3.7; IIL = 4.6; TCM = 4.5; BCM = 2). Most principals frequently summarized, synthesized, and clarified what had been said. Differences between scores of 4 and 5 indicated the degree of frequency with which they carried out these functions. Leaders who diligently synthesize, summarize, and clarify are letting their staff know that what is happening is important, that they want to make sure all understand what is being said so the best possible solution can be developed.

One principal said of her role in the meeting:

> I kind of clarified, I kind of restated, I kind of asked them to substantiate what they were saying if somebody else didn't.

During the staff meeting, another principal said, at various points:

> What kind of stuff are you implying? (asking for clarification)
> Okay, learning difficulties. (restates for clarification)
> What do you mean by that? By the teacher's ability to handle the children?
> Do you think those characteristics fit into different categories? You know, you have short attention span, you have lack of social skills, you [have] chronologically young . . . are all those things to do with maturation? (synthesizing)

In contrast the BCMs were more likely to prevent teachers from having the opportunity to vent their frustrations (even though this was part of what both meetings were set up to do) by cutting off discussions prematurely. For example:

> I felt we were sort of beginning to drift from what was close to the [school]. I'm quite happy with what goes on in school and you can see I'm not happy with what's gone on provincially.

And this from the second building manager:

> I'm saying we could sit around and chat about this ad infinitum and I want to close it off so I think they've talked about that particular thing enough.

Item 15. Evidence from many domains stress the importance of problem-relevant knowledge in accounting for expertise (e.g. Chi, Glaser, & Farr, 1988; Lesgold, 1984). Indeed, Johnson-Laird (1990) claims that, in the study of intellectual development, emphasis has shifted from changes in cognitive structures and processes "... toward the view that what really changes is the content of knowledge (p.485)." Our prior research has paid little attention to domain-specific knowledge. But its importance could not be overlooked in the present study, especially in the face of the instructional modeling practices of the DILs.

All but one direct and indirect instructional leader exhibited considerable problem relevant or domain specific knowledge. The one who did not was working on a problem that did not call for much display of such knowledge. The knowledge used by these principals was mainly about a specific, short-term problem faced in the schools but these principals were also knowledgeable about the Primary Program.

The scores of TCMs on this item showed wide variation. One received a 2 and one received a 4.5. The score of 2 could be explained by the nature of the problem-solving session which didn't require the display of much knowledge.

Building-centred managers exhibited little problem-relevant knowledge. Teachers were responsible for program-relevant knowledge as these comments by one of the principals suggest:

> Well do we know much money is being allocated to the books? To the school?
> I said to them, when do you see a kindergarten becoming what is in fact a k-1?

Dispositions/Attitudes

Three personal characteristics were significantly linked with expertise in collaborative problem solving: appearing calm and confident (Item 13), demonstrating genuine respect for staff (Item 14), and exhibiting habits of self-reflection (Item 16).

Item 13. Along with one's goals and existing knowledge, research in the field of social cognition identifies mood as a variable directly influencing the flexibility of one's thinking, (Showers and Cantor, 1985). Cognitive flexibility, in turn, is central to expert problem solving. Schwenk's (1988) review of research provides evidence of this claim in relation to senior managers in private corporations, for example.

Our prior research found expert administrators remaining more calm and confident during problem solving than non-experts (Stager & Leithwood, 1989). In the present study, although all IILs and DILs overtly appeared calm and confident (all received scores of 4 or 5), four of the eight admitted to feelings of anxiety or frustration. As one said after listening to the tape recording of their staff meeting:

> . . . this may sound strange to you [but I'm] always so worried about talking too much in the meetings and I don't feel as badly as I thought I would.

Another said:

> I felt rather frustrated at this point in the conversation because they wanted to talk about specifics . . . (But frustration was not apparent in the meeting.)

Both teacher-centred managers admitted to being a little uncomfortable at some points in the meeting. With one principal, it was not evident (score = 4); it was slightly more evident with the other because of the excessive amount he talked (score = 3).

> Okay now probably it's my personality but the fact that they aren't talking in this meeting bothered me . . . they didn't feel comfortable to open up and talk. (This principal did not give the teachers much of a chance to talk).

One of the most obvious differences between the BCMs and those in the other patterns is in the degree of annoyance felt and shown; the building-centred managers were frequently perturbed and were not concerned about hiding their anger.

> I would think I sounded a bit peremptory [at this point in the staff meeting]. And, if that's how I sounded, that's how I meant to sound.

Item 14. One of the best ways to empower teachers is for principals to directly demonstrate their respect. However, it is crucial that this respect be genuine; teachers will know the difference.

For the most part, DILs and IILs were genuine and consistent in the high regard they showed their staff members (five received scores of 5, 1 received a score of 4). They knew their teachers well, valued their contributions, and praised them during and after the meeting. Attention to this factor is crucial for creating an atmosphere of trust in which teachers feel free to express themselves honestly. The following quotes illustrate how this respect was expressed in interviews with the researchers:

> Time is really precious to them and that's something else that is really important for an administrator to remember - don't waste their time. *(Subject 10)*
> . . . this is a very good staff, a very confident staff, and I think, for any misgivings they have about it, once they got into it, I think they would make it really work. *(Subject 11)*
> With the teachers, you can't expect them to read everything, but at least you have to have it in a form so it's available . . . and, of course, it keeps the interest up when you give them a chance to do [something] . . . they've all signed up for another summer institute . . . *(Subject 3)*
> . . . Terrific teacher! She's really very very good and tremendously conscientious, so this is why there's a bit of hesitancy on her part all of a sudden. *(Subject 7)*
> . . . and M. was the one, by the way, who had all negative responses and it wasn't her fault. This is her first year in the school and she has just a very powerful class and a very powerful set of parents. *(Subject 8)*

Two of the indirect instructional leaders, however, were less consistent and they each received a score of 3. To illustrate:

> Well . . . one thing that was striking me obviously because it's bugging me again, there are a couple of people in there who are always wanting, whining . . . And I have a hard time valuing their opinions sometimes.

Item 16. A central difference between experts and non-experts in "knowledge-rich" domains of problem solving is that experts possess substantially more problem-relevant knowledge. This often allows experts to solve problems readily, primarily by recognizing them as instances of familiar problem types; lack of problem-relevant knowledge requires an often difficult search for a solution, in contrast. But what explains the knowledge possessed by the expert? As Van Lehn argues: ". . . the ultimate explanation for the form and content of the human expert's knowledge is the learning processes that they went through in obtaining it. Thus the best theory of expert problem solving is a theory of learning (1990, p.529)." Self-reflection and evaluation (item 16) are habits of mind that allow one to learn from experience. In the case of principals, those with greater expertise would be expected to demonstrate, in their problem solving in groups, more self reflection and evaluation and this would help explain their expertise. Our data conformed to this expectation.

The scores of DILs differed substantially from IILs (mean = 4.7 vs 3.6) on this item. DILs were very quick to notice errors they might have made. Perhaps they are always vigilant for opportunities to improve their practice. This vigilance is illustrated in the following comments on their own problem solving as they listened to the taped staff meetings:

> I should have jumped in here. Part of it, I was feeling a little bit of tension . . . part of it is that I'm not sometimes as aggressive as I should be in certain situations.

And from another:

> Okay, that was my first mistake . . . if I had to do it over again, I would have deleted it completely.
> . . . I'm coming out of this meeting feeling, you know, I really haven't handled this very well because, in the end, I didn't get them thinking, 'Hooray, let's just go for this!' But that may be a stage . . .

And this, from an IIL:

> I don't think I handled it particularly well because I'm a bit ambiguous on the topic.

TCMs were similar to IILs. Their mean score of 3.5 indicates a medium amount of self-reflection. BCMs with a mean score of 1.5, showed little reflection.

Problem-Solving Expertise and its Relationship to Age, Experience and Gender

Table 4 reports level of problem-solving expertise, pattern of practice, estimated age (we did not request this information directly), years of experience as a principal and gender for each of the 12 principals in the study. These data are reported for principals in descending order of their expertise.

Table 4

Relationship Between Problem-Solving Expertise, Age, Experience and Gender

	Ratings of Expertise					
S#	Total Score	Mean Score	Patterns of Practice	Age	# Yrs. as Princ.	Gender
8	83	4.61	IIL	56+	4	F
3	79	4.39	IIL	56+	28	F
11	78	4.33	DIL	46-55	1	F
7	76	4.22	IIL	36-45	2	F
10	70	3.89	DIL	36-45	1	F
9	69	3.83	DIL	36-45	1	F
12	68	3.78	TCM	46-55	12	M
5	68	3.78	IIL	36-45	7	M
6	61	3.39	IIL	36-45	5	F
2	59	3.23	TCM	46-55	28	M
4	37	2.01	BCM	56+	15	M
1	36	2.00	BCM	46-55	18	M

There were 7 female and 5 male administrators. All instructional leaders but one (an IIL), were female; all teacher-centred and building-centred managers were male. This lends support to the finding that female administrators, on average, devote a greater amount and more direct attention than males to classroom instructional practices (e.g. Hallinger, Bickman & Davis, 1990; Shakeshaft, 1987). Gender alone, however, is not a sufficient explanation for leadership style. In addition to being female, all three direct instructional leaders were also first year administrators. Two related interpretations are possible.

First year principals may be more inclined to model instructional strategies in the classroom not because they are women, but because they are very familiar with the strategies and feel confident to teach them. This may well be the situation here, since the Primary Program policy encourages instructional practices that are quite different from those considered effective a decade ago and, thus, would not be as familiar to principals who had been in the role for a long time. A related explanation concerns the notion that new administrators may be in a 'transition' year and are finding a way to bridge the gap between the teacher's classroom and the principal's office. Support for this notion is provided by the fact that Indirect Instructional Leaders were also relatively new to the role in contrast with those adopting the two other styles. Whether it is due to reluctance to break with the past, a love of teaching, a strong belief that he/she knows how to do it best, or an awareness that teachers learn best when new strategies are modelled for them, number of years in the role may provide some of the rationale for leadership style.

The two anomalies in the sample tend to confirm the above interpretation. The one male instructional leader is from a district where all of the principals in our sample were indirect instructional leaders (a possible district effect), however, he had also been a principal for a relatively short time (7 years). One instructional leader was in a district that had no other instructional leaders and had been a principal for 28 years, but she was female.

While these data are far from conclusive, they do indicate some interesting connections and perhaps point the way to future research.

Conclusion

Summary

Building on our recent prior research and concerned with how principals solved school improvement problems with their staff, this study explored three questions. We inquired, first, about the relationship between variations in patterns of leadership practices and expertise in group problem-solving processes. Paralleling results of our research on individual problem solving (Leithwood, Steinbach & Dart, in press), principals engaged in both the direct and indirect forms of instructional leadership demonstrated significantly higher levels of group problem-solving expertise than did building-centred managers and substantially higher levels than teacher-centred managers. Teacher-centred managers also demonstrated significantly greater group problem solving expertise than did building-centred managers. Clearly, the thinking giving rise to instructional leadership practices is similar to the thinking that creates an expert collaborative problem solver. These results may help explain some of the variation in impact of different patterns of leadership practice. They also add validity to our growing accumulation of evidence about the links between problem solving and administrative expertise. As a minimum, results offer a more complete understanding of what is involved in each pattern of practice.

To add further depth to our understanding of leadership patterns, we asked, secondly, about aspects or dimensions of group problem solving within which principals differed most. There were ten such dimensions. Differences among principals in these dimensions of group problem solving were most evident in the (a) purposes, (b) skills and knowledge and (c) dispositions principals brought to the process. With respect to purposes, higher levels of expertise were associated with the pursuit of student, program and staff development goals and the ability to help staff place immediate problems in the context of the school's broader mission. Higher levels of expertise were associated with a larger stock of domain-specific knowledge and more refined skills in planning for group problem solving and assisting staff in being as productive as possible during their deliberations; this was accomplished through clarifying, synthesizing and summarizing activities during those deliberations. Finally, dispositions associated with greater group problem-solving expertise included at least the *overt* management or control of intense personal moods, a high regard for staffs' potential contribution to problem solving, and habits of self reflection and evaluation of one's thinking and practices.

Relationships between problem-solving processes and three "demographic" variables - age, experience and gender - was the third question. Each of these variables appeared to explain some of the differences in problem-solving expertise and leadership patterns. The most effective forms of leadership were associated with women having limited formal experience as principals. But marked exceptions were evident indicating that much still has to be learned about variables which give rise to, or interact with, problem-solving processes and leadership patterns.

Implications for Research and Theory

Although limited to 12 elementary principals solving school improvement problems in a common provincial educational context, there are a series of relatively obvious implications for future research related to external validity. These implications raise such questions as follows: Would similar problem-solving processes be used by school administrators in a different educational context? Is there something about the secondary school leadership role that stimulates the use of processes unlike those used by elementary school leaders? Would variations in particular problem domain (school improvement) result in the use of different processes than those observed in this study.

Several questions other than those concerned with external validity are also prompted by the results. First, this study and its immediate predecessors inform us more fully about the nature of problem solving expertise. Nevertheless, little is known about the development of those purposes, skills and knowledge and dispositions around which administrators differed most. Recent research has begun to explore this question (e.g. Leithwood, Steinbach & Begley, 1992) but much remains to be done.

Although problem-relevant knowledge is known to have an influence on problem solving expertise, as yet there has been little attention devoted to discovering what are the important problem domains for school administrators (for one example, see Leithwood, Cousins & Smith, 1990). This question has radical implications for administrator preparation curricula. It suggests that the propositional knowledge offered by such curricula could be organized, more meaningfully, around a grounded (or more phenomenological) conception of the principal's world than is presently the case. This would go some distance toward avoiding the acquisition of inert knowledge by aspiring administrators - knowledge stored in memory but of little practical value since the appropriate occasions for its application usually are not recognized.

Finally, results of the study raise questions about the stability of problem-solving processes across different school contexts. Hallinger, Bickman and Davis (1990) report, for example, that principal leadership practices are best understood through contingency models. Variations in student SES, as well as such variables as gender and parental involvement, change what principals do. But do such variables have a bearing on how principals think - the processes they use to solve problems in groups, for example? Perhaps the thought processes remain stable and the changed practices are only the result of such processes responding to different "information". Were this the case, the value of contingency models of leadership would need to be reconsidered.

Implications for Practice: An Observation About Being Premature

Psychology's greatest disservice to non-psychologists in the past has been to render, through its concepts, language, and methods, understandings of how the human mind functions as opaque, irrelevant and boring. Otherwise, it is hard to imagine a discipline more exciting and more useful for almost anyone to acquire more insight about. Recent work in cognitive science begins to demonstrate this promise and nowhere more vividly than research on practical problem solving (e.g. Rogoff & Lave, 1984; Sternberg & Wagner, 1986). From research with this focus, for example, novice writers are able to make dramatic strides in their own development (Scardamalia, Bereiter, & Steinbach, 1984) and individual students are able to monitor and refine their own learning more autonomously and intentionally (Steinbach, Scardamalia, Burtis, & Bereiter, 1987). Such research also enables us to appreciate the roots and explain the overt practices of those in a variety of professional roles such as teachers and business executives. This knowledge may have considerable value, for example, in future efforts to systematically stimulate the development of expertise in many areas of human enterprise.

But as we begin to inquire more closely into the thinking of educational administrators, we should avoid the temptation of assuming what we will learn and what will be its value for practice. While the theoretical case for great practical significance is a compelling one, we should stand

ready to be surprised - both pleasantly and not so pleasantly. The results of further research are patently unpredictable; the real consequences for practice largely circumstantial. All we can really claim at this time is that what we will learn ought not to be boring.

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